Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
BBR Verkehrstechnik GmbH	)	FCC File No.
	)	
Request for Waiver of Section 15.205(a) of the Commission's Rules	))	

To: Ronald Repasi
Acting Chief
Office of Engineering and Technology

REQUEST FOR WAIVER

BBR Verkehrstechnik GmbH ("BBR"), through counsel and pursuant to Section 1.925 of the Commission's Rules, 47 C.F.R. §1.925, hereby respectfully requests a waiver of Section 15.205(a) of the Commission's Rules, 47 C.F.R. §15.205(a), to install and operate an Automatic Train Protection System ("ATP") on the commuter rail system operated by the Massachusetts Bay Transportation Authority ("MBTA"). In support thereof, the following is shown:

BBR Verkehrstechnik GmbH

BBR Verkehrstechnik GmbH started its business in 1990 and today is a medium-sized company located in Brunswick / Germany. BBR has 200 engineers and technicians currently developing and producing innovative electronic systems and components for the rail industry and for rail operators. The product portfolio comprises electronic point controls, signal boxes, ATP systems and electronic interlockings as well as the corresponding vehicle equipment - both for light and heavy rail.

In the past years BBR has gained a solid reputation as a reliable supplier and partner to many rail operators throughout Germany, Europe, Africa and Asia. Besides public transportation operators our customers also include third party vendors like vehicle manufacturers or other industry customers. BBR is certified according DIN EN ISO 9001, 14001 and Q1-level supplier of Deutsche Bahn. It manufactures electrical components for rail operators. The Company offers control units and systems, data transmission and train control components, signals, and operating modules. BBR serves customers worldwide.

Massachusetts Bay Transportation Authority

The MBTA Green Line is a light rail system run by the Massachusetts Bay Transportation Authority (MBTA) in the Boston, Massachusetts metropolitan area. It is the oldest Boston subway line, and with tunnel sections dating from 1897, the oldest in North America. It runs underground through downtown Boston, and on the surface at-grade and on elevated guideway sections.

The Green Line operates within the municipalities of Cambridge, Boston, Brookline and Newton, and the extension will add the municipalities of Somerville and Medford. The Green Line provides service to these communities on 4 lines, with the central subway splitting up into 4 branches, along 23 miles (37 km) of track and serves 66 stations. It is one of the most heavily used light rail systems in the country with an average daily weekday ridership well above 100,000 riders in 2019.

These 4 branches are the remnants of a large streetcar system, which began in 1856 with the Cambridge Horse Railroad and was consolidated into the Boston Elevated Railway several decades later. The branches all travel downtown through the Tremont Street subway, the oldest subway tunnel in North America. The Tremont Street subway opened its first section in September 1897, to take streetcars off overcrowded downtown streets; it was extended five times over the next five decades. The streetcar system peaked in size around 1930 and was gradually replaced with trackless trolleys and buses, with cuts as late as 1985. The new D branch opened on a converted commuter rail line in 1959; the Green Line Extension project will extend two branches into Somerville and Medford.

The 4 western surface branches each have a letter designation:

The B branch (Commonwealth Ave branch) runs west in a short tunnel from Kenmore, surfacing in the median of Commonwealth Avenue at Blandford Street. It runs 4.2 miles (6.8 km) on Commonwealth Avenue through Boston University, Allston, and Brighton to Boston College station.

The C branch (Beacon Street branch) runs southwest in a tunnel from Kenmore, surfacing in the median of Beacon Street at St. Mary's Street. It runs 2.9 miles (4.7 km) on Beacon Street through Brookline to Cleveland Circle station.

The D branch (Highland branch) diverges from the C branch tunnel southwest of Kenmore, surfacing at Fenway station. It runs 9.7 miles (15.6 km) though Brookline and Newton along the grade-separated Highland branch to Riverside station.

The E branch (Huntington Ave branch) runs southwest through the Huntington Avenue subway from Copley, surfacing in the median of Huntington Avenue at Northeastern University station. It runs 2.6 miles (4.2 km) along Huntington Avenue and South Huntington Avenue to Heath Street, with the outer 0.7 miles (1.1 km) (west of Brigham Circle) in mixed traffic rather than a dedicated median.

All 4 lines run in the central subway, a group of tunnels which run through the urban core and downtown of Boston. The Tremont Street subway runs roughly north–south through downtown, with stations at Boylston, Park Street, Government Center, Haymarket, and North

Station – all with connections to other lines of the MBTA subway system. The Boylston Street subway runs roughly east–west through the Back Bay neighborhood, with stations at Arlington, Copley, Hynes Convention Center, and Kenmore; it connects to the Tremont Street subway at Boylston. The Huntington Avenue subway diverges from the Boylston Street subway at a flat junction west of Copley, running southwest with stations at Prudential and Symphony.

North of North Station, the line inclines up to the Lechmere Viaduct, which crosses the Charles River with an elevated station at Science Park. The GLX will continue north from the Lechmere station, with a now elevated Lechmere station in East Cambridge replacing the former surface terminal. Two branches will split north of Lechmere, the Union Square branch to Union Square, and the Medford branch to Medford/Tufts.

Like the 3 other MBTA subway lines, the Green Line uses standard gauge tracks. However, instead of heavy rail metro rolling stock, the Green Line uses light rail vehicles (LRV's).

In 1986–88, 100 second generation (Type 7) LRVs were delivered from the Japanese firm Kinki Sharyo, with an additional 20 cars ordered and delivered in 1997. The first low-floor Green Line streetcars, allowing for handicapped-accessible boarding directly from slightly raised platforms, were the Type 8 cars from AnsaldoBreda with styling by Pininfarina, which began arriving in 1998.

In 2006, as part of the settlement of Joanne Daniels-Finegold, et al. v. MBTA, the MBTA committed to operating at least one low-floor car in each train, with no trains consisting only of Type 7 cars.

Between 2017 and 2020, 24 new Type 9 Green Line cars were delivered. The Type 9 cars will provide additional rolling stock to allow for Green Line Extension operations and will not replace any of the existing fleet. The cars were made by CAF USA, Inc., with the shells and frames made in Spain, and final assembly and testing done at their plant in Elmira, New York.

Unlike the MBTA heavy rail subway lines, the Green Line has only limited central control and monitoring. The line is signaled with advisory wayside signals, except on surface portions in street medians or in-street running. Wayside signal territory stretches from Lechmere to the surface portals at Kenmore, and along the entire length of the D–Riverside branch. There are currently no automatic protection devices, i.e., there are no stop devices such as trip stops or stop arms on the system; operators are responsible for keeping their cars under control and obeying all signals. In 2013, MBTA Safety assessed the risk for red signal overruns to be unacceptable.

Interlockings are controlled through a wayside Automatic Vehicle Identification (AVI) system that relies on the operator properly entering the destination manually on a thumb wheel in the train cab at the beginning of a run.

The line is monitored from the Operations Control Center (OCC). Responsibility for controlling service is shared by the control room and field personnel along the right of way. Track circuit and signal indications are not transmitted to the operational personnel sites.

Request For Waiver

BBR and the MBTA have a tentative agreement (subject to the Commission's Grant of this requested Waiver) to implement a train protection system on the MBTA's Green Line ("GLPTS"), for the purpose of increasing the safety of the riding public by protecting train movements, preventing red signal overruns, and train to train collisions on tracks used for passenger service. This is accomplished by installing bi-directional wayside balises in front of vital wayside signals, in areas of temporary or permanent speed restrictions and other danger points. The system influences the train based on its present speed, the track geometry, and the aspect of the next signal.

If necessary, the system automatically initializes graded actions from acoustic warnings through enforcing safe speed profiles by operational braking (Speed or ROW Protection) to initiating a forced braking in case a vital signal's stop aspect has been overrun (Red Light Protection).

The equipment sought to be installed by BBR has been used by BBR worldwide for ninety (90) similar instalations worldwide. Further, the signals transmitted by the system are fully compatible with the well-established PZB system manufactured by Siemens, and work together on light rail systems in locations such as Manila (Phillipines) and Saarbrücken (Germany).

BBR's Waiver Request is based upon the system's transmission of a sinusoidal unmodulated carrier on 100 kHz. This subsystem is designed for inductive near-field coupling and has a very low electric field component.

In the United States, only spurious emissions are permited in the 100 kHz band.[1] This is because the band is part of an allocation for Loran-C.[2] However, Loran-C operations were discontinued in 2010.[3] Because Section 87.173(b) of the Commission's Rules has never been updated, the Commission has previously granted several waivers to permit certain types of operation in the band.[4]

BBR respectfully requests similar relief to that granted earlier applicants. The BBR system, installed on the MBTA Green Line, will provide life-saving information to ensure passenger safety. As Loran-C operations have long since been discontinued, no interference will

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[1] 47 C.F.R. §15.205(a).
[2] 47 C.F.R. §87.173(b).
[3] *See LORAN-C Closure, http://www.jproc.ca/hyperbolic/loran_c_closure.html* (noting permanent discontinuance of LORAN-C operations in the United States, as of February 8, 2010).
[4] *See*, for example, *Ms. Cheryl A. Tritt*, 31 FCC Rcd. 7715, DA 16-820, released July 19, 2016; *Respironics, Inc. and Boston Scientific Corporation Requests for Waiver of Section 15.205 of the Commission's Rules to Permit the Marketing and Operation of Certain Medical Communications Devices that Operation in the 90-110 kHz Band*, Order, 21 FCC Rcd 13450 (OET 2006).

be caused to any primary user in the band.[5] Because the equipment has been designed and is in use internationally, and in coordination with other train control systems, modification of the system to emit a sinusoidal unmodulated carrier on another band is not feasable, and even if possible would pose a significant additional design cost for the MBTA without any benefit to the public. Therefore, BBR believes that it has fully complied with the Commission's applicable waiver standards, as reflected in Section 1.925(b)(3) of the Commission's Rules.[6]

WHEREFORE, the premises considered, it is respectfully requested that the Commission WAIVER section 15.205(a) of its Rules to permit BBR Verkehrstechnik GmbH to install its Automatic Train Protection system on the Massachusetts Bay Transportation Authority's Green Line.[7]

Respectfully submitted,

BBR Verkehrstechnik GmbH

By: Alan S. Tilles, Esquire

Its Attorney

Shulman Rogers Gandal Pordy & Ecker, P.A.
12505 Park Potomac Ave., Sixth Floor
Potomac, Maryland 20854
(301) 230-5200

Date: July 2, 2021

[5] Please note that upon Commission grant of this Request for Waiver, BBR will submit its equipment to a Telecommunication Certification Body ("TCB") for a statement of compliance with the technical parameters of the Commission's Grant.

[6] *WAIT Radio v. FCC*, 418 F.2d 1153 (D.C. Cir. 1969).

[7] Attached hereto please find a technical description of the system, as well as a letter from the Massachusetts Bay Transportation Authority stating its desire to install the BBR system.

Technical Description
PZB2X2 Automatic Train Protection System

Revision History

Revision			Revised Chapters	Details	Author
No.	Date	Version			
1	2021-04-22	1.0	all	Creation	Dr. Thomas Scheller
2	2021-04-23	1.1	all	Worked in Comments	Dr. Thomas Scheller
3	2021-04-27	1.2	all	Worked in Comments and Dates	Dr. Thomas Scheller
4	2021-04-28	1.3	4	Changed decimal point in table 2	Dr. Thomas Scheller
5	2021-05-12	1.4	all	Updates and additions	Dr. Thomas Scheller
6	2021-05-12	2.0	./.	Review and approval	Mathias Krueger

Review Table

Internal Review

Date	Version	Comments	Reviewer
2021-05-12	1.4	./.	Mathias Krueger

External Review

Date	Version	Comments	Reviewer

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Abbreviations and Definitions

Abbreviation	Definition / Meaning
FSK	Frequency Shift Keying
GLTPS	MBTA Green Line Train Protection System
INDUSI	Induktive Zugsicherung / Inductive Train Protection System
PZB	Punktförmige Zugbeeinflussung / Punctiform Train Influencing
ROW	Right-of-way

1 System Purpose

BBR is providing the PZB2X2 ATP system to the MBTA for the Green Line Train Protection System (GLTPS) for the purpose of increasing the safety of the riding public by protecting train movements, preventing red signal overruns, and train to train collisions on tracks used for passenger service. This is accomplished by installing bi-directional wayside balises in front of vital wayside signals, in areas of temporary or permanent speed restrictions and other danger points. The system influences the train based on its present speed, the track geometry, and the aspect of the next signal. If necessary, the system automatically initializes graded actions from acoustic warnings through enforcing safe speed profiles by operational braking (Speed or ROW Protection) to initiating a forced braking in case a vital signal's stop aspect has been overrun (Red Light Protection).

2 System components

Communication between trains and wayside balises is provided by vehicle coupling coils like the PZB1052 FZK (Figure 1) or the shorter version PZB1055 FZK (Figure 2). Both devices are electronically identical but differ in external size.

Figure 1: PZB1052 FZK vehicle coupling coil

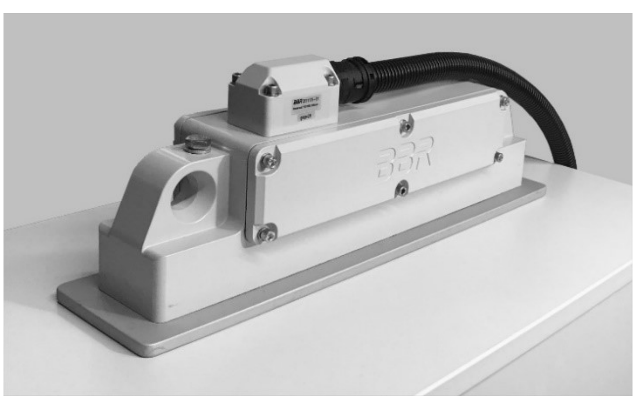

Figure 2: PZB1055 FZK vehicle coupling coil

PZB1050 GKS Balises (Figure 3) can be configured to transmit static and dynamic information. All dynamic data is chosen at positions where the same restriction has to be transmitted to every train (for example due to civil constraints like speed restrictions in curves or due to wayside construction work).

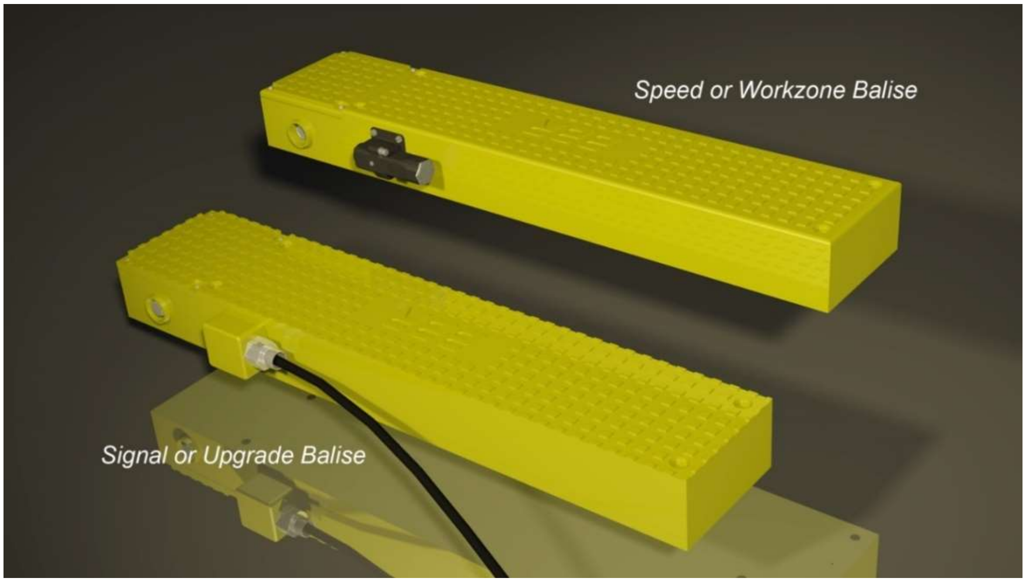

Figure 3: PZB1050 GKS balises

3 System operation

Vehicle coupling coils receive data communication from the wayside balises. The information is transmitted at a frequency of 850 kHz from the balise to the vehicle coupling coil. The binary data is transmitted in messages using Frequency Shift Keying (FSK).

The power for the balises is provided by the vehicle coupling coil via a magnetic field oscillating at 100 kHz. This field is not modulated. The balises couple inductively into this field resulting in a near-field energy transmission. Only reactive power is transferred, the active power emissions are very low. This inductive near-field enrgy transfer allows all wayside balises to operate without any form of wayside power supply. The 100 kHz unmodulated signal is permanently transmitted as long as the vehicle coupling coil is powered.

The PZB2X2 system also utilizes a 50 kHz subsystem which acts as the vital part of every signal balise. The 50 kHz subsystem provides monitoring of the faultless function of the wayside balises via an inductively coupled resonant circuit. This control circuit permits detection of balises even when the 850 kHz data channel is in a defective state. Because of its inductive electromagnetic principle, which has been used since the 1920s in Germany, this 50 kHz part is also named INDUSI antenna. The 50 kHz unmodulated signal is permanently transmitted as long as the vehicle coupling coil is powered. When a balise is detected the vehicle coupling coil 50 kHz transmitter temporarily pauses its 50 kHz transmissions.

A graphical schematic of the subsystems is given in Figure 4. The operational distance range between PZB1050 balise and PZB1052/PZB1055 vehicle coupling coil is given in Table 1.

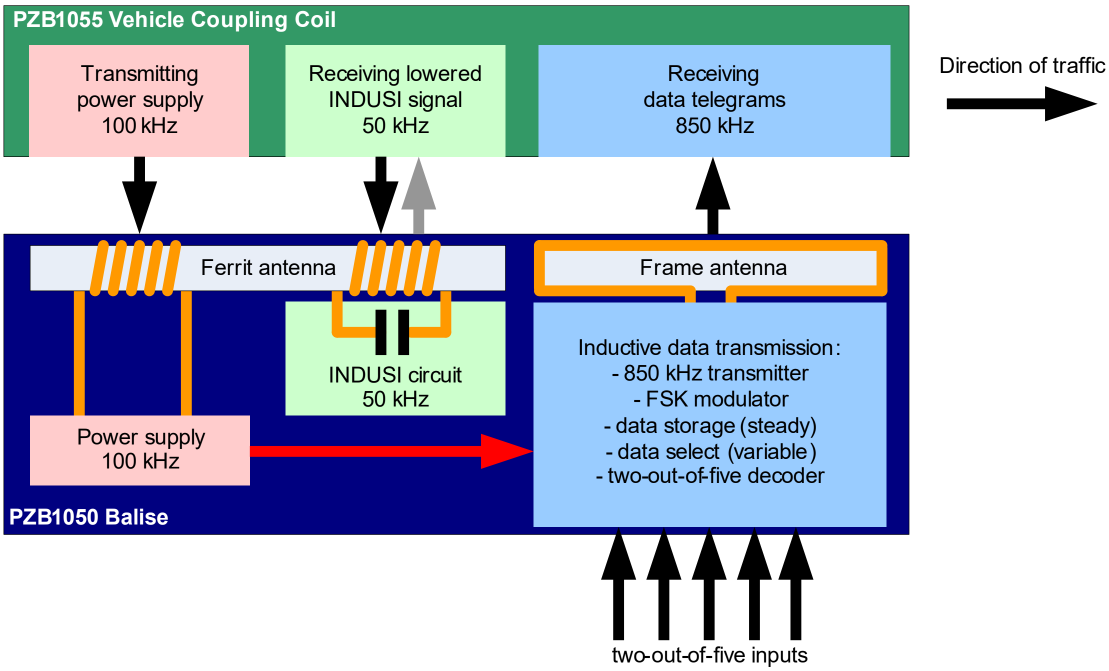

Figure 4: Schematic Summary of PZB1050 and PZB1052/PZB1055 subsystems

Table 1: Operation distance

Description	Value	Comment
Operational system distance (obligatory)	140 mm till 220 mm	Between lower rim of the vehicle coupling coil and upper rim of the track balise/coupling coil under consideration of spring travels, wheel rim attrition and rail head attrition.
Nominal system distance	180 mm	Between lower rim of the vehicle coupling coil and upper rim of the track balise/coupling coil when vehicle is unloaded (dependent on operational conditions).

As shown in Figure 5 both vehicle coupling coil and the balise are mounted well within the clearance envelope of the train tracks. To prevent damage or accidents no installation, devices or persons are allowed within this clearance envelope during normal operation. This also applies to wireless communication devices apart from those required for safe operation of the railway. Furthermore due to the optimization for near-field inductive coupling the emitted field strength sharply drops for distances greater than the maximal operation distance given in Table 1 which minimizes the risk of disturbing systems outside of the clearance envelope. Therefore, we do not expect any conflicts with radio systems using the protected 100 kHz frequency band in distances above 10 m.

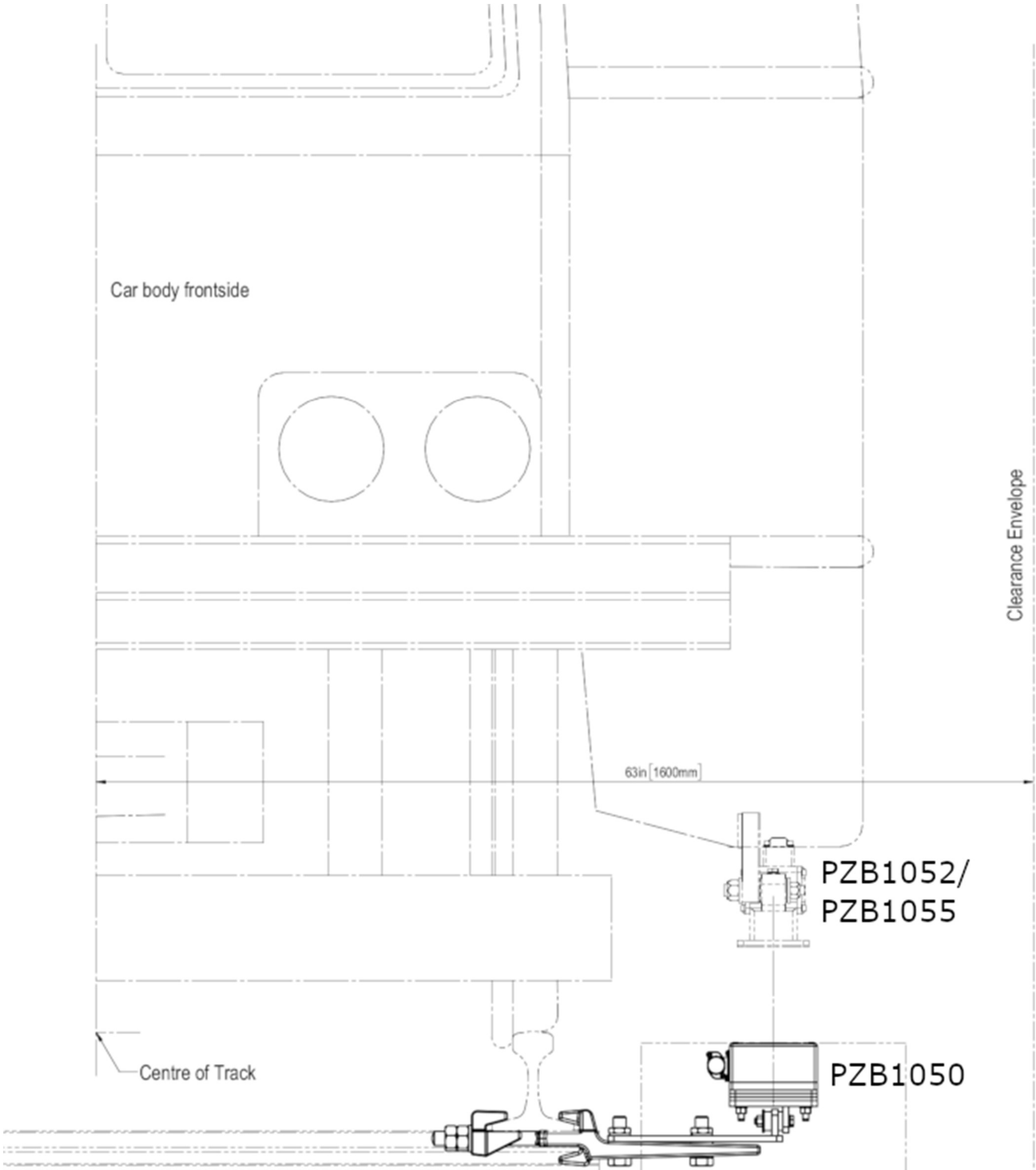

Figure 5: System component placement relative to train

4 Wireless transmission specifications

The design specifications of all three wireless subsystems are given in Table 2. The system imitates a discontinued system of a competitor. Therefore, the electromagnetic characteristics have been tuned to be similar to the competitor’s system.

Table 2: wireless transmission specifications

Description	Value	Tolerance
50 kHz detector (vehicle coupling coil)		
Operation voltage	24 V	±5 %
Power consumption	220 mA	±10 %
Carrier frequency	50 kHz	±10 Hz
Transmission level (155 mm from the lower rim)	137 dBµA/m	±2 dB
100 kHz generator (vehicle coupling coil)		
Operation voltage	24 V	±5 %
Power consumption	600 mA	±5 %
Carrier frequency	100.1 kHz	±20 Hz
Transmission level (155 mm from the lower rim)	147 dBµA/m	±2 dB
850 kHz data transmission (balise)		
Center frequency	850 kHz	±10 kHz
Bandwidth	210 kHz	±10 kHz
Transmission level (155 mm from the upper rim)	98 dBµA/m	±2 dB

In Germany the maximum allowed field strength at 100 kHz is 66 dBµA/m in 10 m distance. The 100 kHz generator is usually about 6 dB below that limit. The maximum available power for the 100 kHz generator is 14,4 W

5 Installation references

The exising equipment to be provided by BBR for MBTA has a successful service proven history. The combination of the PZB1052 vehicle coupling coil and the PZB1050 has been installed in 90 light rail vehicles and the ROW in the city of Bursa (Turkey) since 2011 as well as 30 light rail vehicles and the ROW in two cities in the Republic of China (Taiwan) since 2018.

Furthermore, the transmitted signals are fully compatible to a well-established PZB system manufactured by Siemens. The PZB1050 balises are installed, for example, on the tracks of light rail systems in Manila (Philippines) and Saarbrücken (Germany).

6 Annex

6.1 Norms and Standards

No	Abbreviation	Titel	Issue Date
[1]	-	-	-

6.2 Literature

No	Name	Filename / Storage Path	Version
[2]	-	-	-

Charles D. Baker, Governor
Karyn E. Polito, Lieutenant Governor
Jamey Tesler, Acting MassDOT Secretary & CEO
Steve Poftak, General Manager

massDOT
Massachusetts Department of Transportation

June 14, 2021

Federal Communications Commission
Washington, D.C. 20554

Re: BBR Verkehrstechnik GmbH
Request For Waiver

To Whom It May Concern:

The Massachusetts Bay Transportation Authority ("MBTA") has reviewed the Request for Waiver prepared by BBR Verkehrstechnik GmbH ("BBR"). This letter is to confirm that the information contained therein is accurate and it is the MBTA's intention to install the BBR rail safety system as soon as possible after Commission approval of the Request for Waiver.

After much preparation and planning to address NTSB safety recommendation R-09-14, the BBR system was chosen by MBTA to provide a train protection solution for the manually operated Green Line. As the Green Line is the oldest line at the MBTA, with some tunnels dating back to the 1800s, a custom train protection solution such as BBR's is required to both successfully protect trains and produce an effective level of service. That said, arriving at this solution has taken quite a while with the above recommendation being published in 2009. Based on the criticality of addressing this safety recommendation and the impact that would be had if this solution cannot be implemented, the MBTA sincerely asks for the FCC's consideration of the referenced waiver.

Should you have any questions concerning this matter, please contact the below-signed.

Sincerely,

Brian DeRosa, Project Manager
Green Line Transformation
Massachusetts Bay Transportation Authority